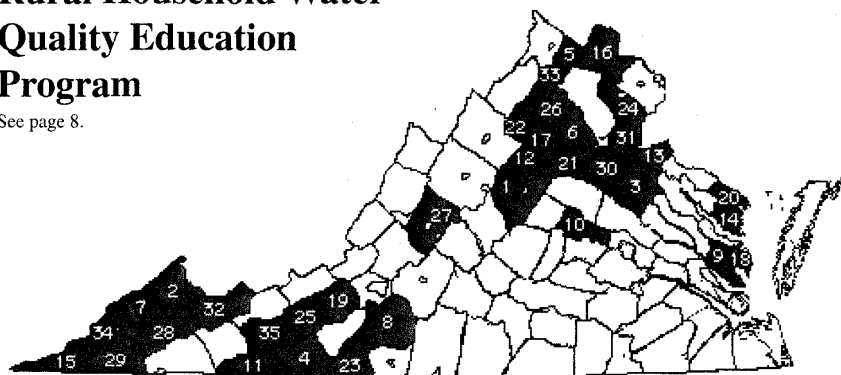


## Rural Household Water Quality Education Program

See page 8.



## I. PERSPECTIVE

### Ground Water Protection Steering Committee 1997 Activities

The Ground Water Protection Steering Committee's eleventh year saw continued emphasis on the goals of the 1995 Supplement to the Ground Water Protection Strategy for Virginia. Particular emphasis was made at bi-monthly meetings on education and information exchange. At each meeting, the Steering Committee heard presentations from members and outside experts on a variety of ground water related topics ranging from the impacts of new legislative acts on regulations and policy - such as the Safe Drinking Water Act Amendments, the Agricultural Stewardship Act and the Ground Water Management Act - to demonstrations and explanations of new technology used by member agencies - such as the Department of Mines, Minerals and Energy digital hydrogeologic data base in Albemarle County and their new electronic permitting system.

Also in the spirit of information exchange, the Steering Committee decided to develop a web site explaining the Committee's activities and resources (for more information see p. 12). The web site includes answers to frequently asked questions, information about member agencies, links to other ground water resources, and an electronic version of this Annual Report.

Over the year, a greater interest in Steering Committee activities has been demonstrated by an increased number of non-members attending meetings and bringing new information and resources to the Steering Committee's attention. This increased attendance has also helped spread the word of ground water's importance.

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Come visit the new Steering Committee Web site at:

<http://www.deq.state.va.us/gwpsc/home.html>

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## II. ACTIVITIES and SERVICES

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### ***Chesapeake Bay Preservation Act Regulations Being Amended***

The Chesapeake Bay Local Assistance Board and Department are progressing through a process to amend the Chesapeake Bay Preservation Area Designation and Management Regulations (9VAC10-20-20 et seq. of the Virginia Administrative Code). The Board began the process a year ago by announcing its intention to amend the regulations and inviting public comment during the summer. In October 1996, the Board established a regulation advisory committee, which has been meeting since then to thoroughly review the regulations, focusing on certain issues that have been the source of contention or confusion. The committee has completed its initial work, and the Board was presented a draft set of amendments for consideration at its June 16, 1997 meeting.

Several recommended changes should result in positive impacts on ground water. First, the committee is recommending that local governments be provided options to the existing septic system criteria to provide more flexibility while still protecting water quality. Included is an option to allow homeowners to install an outflow filter in their septic tanks as an alternative to the mandatory 5-year pump-out provision. The filters prevent larger solid materials from flowing into the drainfield. When the septic tank becomes filled to a critical level with solids, the homeowner will notice slower flushing and recognize that it is time to have the tank pumped out.

The committee also recommended allowing localities to provide the option of using an alternating drainfield system as an alternative to the 100-percent reserve drainfield requirement. Alternating drainfields have been used in Fairfax County for many years, and anecdotal

evidence appears to support that such systems do, indeed, extend the functional life of drainfields. This option would have the affect of reducing the amount of land needed for the septic system.

Finally, the committee recommended that the nutrient management components of agricultural soil and water quality conservation plans be based on soil tests. This has not previously been required. However, testimony before the committee indicated that nutrient management plans drafted without specific soil information are very speculative and provide no confidence that nutrient pollution in runoff and ground water will be significantly curtailed. Farmers have complained that soil tests cost too much. However, the committee was presented with information that the cost savings resulting from implementation of a nutrient management plan, based on soil test information, almost always exceed the cost of the tests, and sometimes exceed the test costs substantially. Furthermore, the Commonwealth is currently considering making the costs of soil tests eligible for the BMP tax credit program, which would provide some reimbursement.

Once the Board endorses a draft of the regulation amendments, the Department will work with the Department of Planning and Budget on an economic impact analysis of the recommended changes. The staff anticipates that the amendments will be published during Fall 1997 for a 60-day public comment period, including several public hearings in different locations around Tidewater. Adoption of final regulations is expected by early 1998. For more information, contact Scott Crafton at 1-800-CHESBAY.

Funding for the Virginia Ground Water Protection Steering Committee activities, including development of this Report, is provided through a grant to the Department of Environmental Quality by the US Environmental Protection Agency.

### ***Agricultural Stewardship Act***

Early in 1995, Virginia's agricultural leadership began discussing ideas for a proactive way of dealing with agricultural water pollution emanating from agricultural operations that were not already required to have water quality permits. The agricultural community wanted a process that was different from the approaches used with other industries, such as manufacturers. Most manufacturing plants must obtain permits and follow strict rules of operation. The agricultural community wanted a different approach that did not rely on permits or strict operating rules, but took into account the wide variety of farming practices used in Virginia. The result was the Agricultural Stewardship Act (ASA), which was enacted by the 1996 General Assembly and went into effect on April 1, 1997.

The ASA resulted from the joint work of representatives of Virginia's agricultural community, environmental community, Association of Soil and Water Conservation Districts, and state agencies. They sought to develop procedures by which individual agricultural producers can be alerted to areas of their operations that may be causing water pollution. Rather than developing regulations with strict rules governing every type of farming practice, the ASA looks at each farm individually.

The procedures created by the ASA begin with a complaint made to the Commissioner of Virginia's Department of Agriculture and Consumer Services (VDACS). The Commissioner must accept complaints alleging that a specific agricultural activity is causing or will cause water pollution. After the Commissioner receives a complaint under the ASA's jurisdiction, he will ask the local Soil and Water Conservation District ("District" or "local district") whether it wishes to investigate the complaint. If the District does not wish to investigate the complaint, the Commissioner will investigate.

The purpose of the investigation is to determine whether the agricultural activity that was the subject of the complaint is causing or will cause water

pollution. If not, the Commissioner will dismiss the complaint and inform the person who made the complaint.

If the agricultural activity is causing or will cause water pollution, the ASA gives the farmer an opportunity to correct the problem. The farmer will be asked to develop a plan containing "stewardship measures" (often referred to as "best management practices") to prevent the water pollution. The farmer then develops the plan, and once the plan is complete, the District reviews it and makes recommendations to the Commissioner. If the Commissioner approves the plan, he will then ask the farmer to implement the plan within specified periods of time.

If the farmer does not develop a plan, or if the farmer develops a plan, but fails to implement it, then (and only then) will enforcement action under the ASA be taken against the farmer.

In some cases, the ASA investigation will not produce sufficient evidence to support the conclusion that the agricultural activity in question is causing or will cause pollution. In those cases, the investigator will see if the farmer is receptive to suggestions on how the farmer might improve practices to prevent complaints in the future. This educational role of the investigator is just as important as anything else the investigator does pursuant to the ASA.

The ASA applies to agricultural activities that are causing or will cause water pollution by sedimentation, nutrients or toxins. The only exception is when the agricultural activity in question is already permitted by the State Water Control Board (through the Department of Environmental Quality). The permits are usually: a Virginia Pollution Abatement ("VPA") permit (general or individual) for the storage and land application of animal waste; a Virginia Pollution Discharge Elimination System ("VPDES") permit for certain aquaculture facilities or for mixed production and processing operations; or a VPA permit for the land application of sewage sludge.

#### **ACT APPLIES TO WATER POLLUTION FROM AGRICULTURAL ACTIVITIES**

The ASA does not apply to forestry activities, nor does it apply to odor concerns. Nor does the ASA apply to landfills or waste problems that do not

involve agricultural products and that have no clear water quality impacts. Finally, the ASA does not apply to air pollution, nor does it apply to water pollution caused by non-agricultural activities.

#### **ACT DOES NOT APPLY TO:**

- \* PERMITTED  
ACTIVITIES**
- \* FORESTRY**
- \* ODORS/AIR POLLUTION**
- \* LANDFILLS**

For more information regarding the ASA or related topics, contact Sarah Pugh, Glenn Martin or Hunter Richardson of VDACS at 804-786-3538.

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## ***The Water Quality Improvement Act of 1997***

Earlier this year Governor Allen signed into law the Water Quality Improvement Act of 1997. Motivated by the need to finance the Potomac River Basin Tributary Strategy and the lower basin strategies that are now being developed, the original bill, introduced by the Governor, focused on the effort made by the citizens of the Potomac Basin to craft a policy to reduce excessive nutrients (nitrogen and phosphorus) entering the Chesapeake Bay. During the course of the legislative session and in consultation with stakeholders of all views and persuasions, the Act took on statewide characteristics and now will fund water quality improvement activities in areas with tributary strategies as well as areas of the State that are outside the Chesapeake Bay drainage area.

The purpose of The Virginia Water Quality Improvement Act of 1997 is to restore and improve the quality of state waters and to protect them from impairment and destruction for the benefit of current and future citizens of the Commonwealth. Because this is a shared responsibility among state and local government and individuals, the Act creates The Virginia Water Quality Improvement Fund.

Through the Fund, state agencies will provide Water Quality Improvement Grants to local governments, soil and

water conservation districts, and individuals for point and non-point source pollution prevention, reduction, and control programs. The Department of Environmental Quality has the responsibility to provide technical and financial assistance to local governments and individuals in the control of point source pollution. The Department of Conservation and Recreation has the lead responsibility to provide technical and financial assistance to local governments, soil and water conservation districts, and individuals in the control of non-point source pollution.

In the 1997 Amendments to the Commonwealth's biennial budget, the General Assembly appropriated \$15 million for the first year of the Fund (July 1, 1997 through June 30, 1998). Of this, \$10 million is to be used for point source projects, and \$5 million for non-point source projects. Since this is a nonreverting fund, any money not spent in the first year will remain in the Fund for use in subsequent years.

Grants from the Fund will be provided as matching funds, usually on a 50-50 cost share basis. Thus a total of approximately \$30 million worth of water quality improvement projects may be initiated during the first year.

During the first year of the Fund all of the point source money, and one-half of the non-point source money, will be spent in the Shenandoah and Potomac watersheds for projects that reduce excessive nutrients. The other half of the non-point source money may be used to remedy other water pollution problems, and must be used outside of the Chesapeake Bay watershed.

This means that some areas of the state will not receive funds during the first year of the Fund. Specifically, tributary strategies are under active development for the watersheds of the Rappahannock, York, and James rivers; for other small watersheds that drain into the Bay; and for the Eastern Shore. These areas will become eligible for funding when those strategies are complete.

A draft of the guidelines that will govern the distribution of grants from the Fund has been prepared for written comments, and the final guidelines will be published around July 1, 1997.

For more information contact Stu Wilson of the Department of Conservation and Recreation, at 804-786-4382.

## Ground Water Monitoring in Polecat Creek

This past spring, the Chesapeake Bay Local Assistance Department (CBLAD) entered into a contract with the U.S. Geological Survey (USGS) to conduct ground water monitoring as part of the long-term trend monitoring network in the Polecat Creek watershed of Caroline County. The Department has been monitoring stream flow, water chemistry, aquatic biota, and rainfall for a few years as part of a ten-year monitoring project to test the efficacy of the Chesapeake Bay Preservation Act regulations in protecting water quality, particularly from the impacts of land development.

In June of 1997, the USGS installed two transects of test wells. Each transect is composed of several wells on each side of the stream. These wells have been drilled to various depths in order to sample water found at different depths. Transects are located in the headwaters of the watershed, in the Piedmont region, and downstream in the Coastal Plain, a few miles above the conjunction of Polecat Creek with the Mattaponi River. These first two transects were installed in agricultural areas. Over time, additional transects will be located in different land use areas, including forested and developed areas.

The USGS staff will be determining the flow periods, history, and chemistry for ground water in this watershed and, ultimately, attempting to learn if pollution is flowing into the stream system through ground water. If so, CBLAD and USGS will attempt to determine the sources of the pollution. Ultimately, findings of this entire project will be used to determine whether the Bay Act regulations are effective in protecting water quality impacted by varying land uses and, if not, what changes may be needed for them to be more effective.

For more information, contact Darryl Glover of CBLAD at 1-800-CHESBAY or 804-371-7501, or Randy McFarland of USGS at 804-278-4750, ext. 267.

## Successful Communities: EPA Wellhead Protection Workshop

The US EPA and the Institute for Environmental Negotiation, University of Virginia, held a Wellhead Protection Workshop in Richmond on August 18-19, 1997. The Workshop highlighted communities which successfully implemented ground water protection programs in EPA Regions III and IV. Several dozen participants from state and local government learned about the challenges, opportunities and successes associated with developing, implementing and maintaining local wellhead protection programs. Representing a range of urban and rural, large and small, simple and complex programs from several different states, representatives from several model communities discussed how they overcame political, technical, and legal obstacles and developed innovative partnerships, adopted zoning regulations, appropriated funds, established clear responsibilities and undertook effective management strategies.

*Continued from page 5*

Another resource from Project WET is the **Water Resources Education Trunk** - a trunk filled with educational resources including a ground water flow model, instructional videos, lesson plans, maps, posters, reference books and a Chesapeake Bay mini-unit. Trunks can be borrowed from state parks and Soil & Water Conservation offices around the state.

- For more information about **Project Underground**, contact: Carol Zokaite, Project Director  
620 McDaniel Drive  
Christiansburg, VA 24073  
(540) 381-8234; email: zokaite@usit.net

- For more information about **Project WET**, contact: Ann Regn, Environmental Education Coordinator  
DEQ  
PO Box 10009  
Richmond, VA 23240-0009  
(804) 698-4442; Fax: (804) 698-4453; email: amregn@deq.state.va.us

## Virginia's Karst Project Update

Virginia's Karst Project has several ongoing efforts to address water quality issues related to waste and materials management, land use planning, storm water management, erosion/sediment control, and habitat conservation in karst terrain. A primary emphasis of Virginia's Karst Project is the delineation of ground water basins within karst watersheds for the purpose of pollution prevention. Current activities include the following:

- A sinkhole clean-out on a local high school campus (with the US Fish and Wildlife Service);
- Development of best management practices for timber harvests on karstlands (with the US Forest Service);
- Monitoring and tracer testing contaminated springs and cave streams (with Virginia's Department of Environmental Quality);
- Designing storm water studies in cavernous areas (with local governments and the US Geological Survey); and,
- Cooperating in the development of a karst video for local planning commissions and county supervisors.

In 1997-98, project staff will focus on generating recommendations for the designation of Source Water Protection Areas (SWPAs) and conducting local assessments in karstlands.

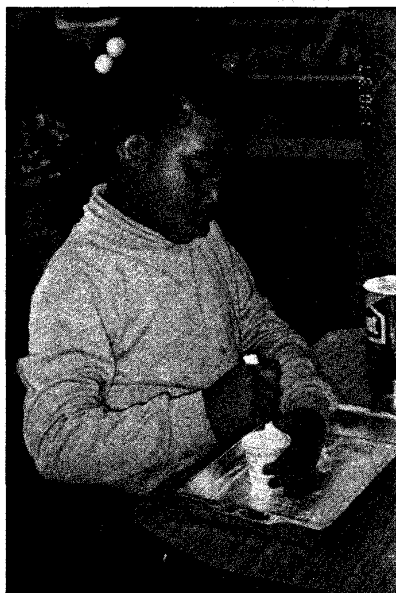
The Department of Conservation and Recreation (DCR), Division of Natural Heritage administers Virginia's Karst Project with federal Nonpoint Source funding allocated by the Division of Soil and Water Conservation, in addition to other sources. The dissemination of useful information to the public is an important element of the Karst Project, which assisted the Cave Conservancy of the Virginias in producing *A Landowners Guide to Living on Karst*. The booklet is being distributed to caving, conservation, and natural resource management organizations throughout the state and east-central US. DCR also reprinted the 1996 collection of model local ordinances and karst protection tools known as *Living on Karst* to satisfy continuing public requests for this type of information. For copies of either of these documents, please contact Faye McKinney at DCR at 804-786-7951 or Terri Brown at 540-674-5541.

## Project WET Goes Underground in Virginia

Peering down into "Big Muddy," a sinkhole that backfloods when the South Fork of the Shenandoah River overflows, 25 educators learned how Warren County's karst topography is an important source of ground water and base flow to the South Fork, and one that supports the habitats of several globally rare cave species. The field trip, led by Terri Brown, a hydrologist for the Department of Conservation and Recreation, culminated a 3-day training seminar on ground water and karst resources.

During the training, educators learned how to conduct Project WET activities such as *H2Olympics*, *Common Water*, and *The Incredible Journey*. Participants also learned the fundamentals about ground water monitoring, how to use a ground water flow model, and how to make a well log using Project WET's hand-on instructional lessons. The interactive strategies continued during day two when participants were introduced to Project Underground, a curriculum supplement on caves and karst resources. The activities in this

guide, as in Project WET, are designed to increase the understanding of the resource and build responsible attitudes toward management. In *Lost River Village*, students actually plan the layout of a community and then investigate



how the placement of farms, gas stations, water treatment plants and other businesses, as well as open space, affect the ground water in karst areas. To

supplement the activities, technical information via slides and written materials was provided by Terri Brown and Mary Ann Massie, from the Department of Environmental Quality.

The Project WET *Curriculum and Activity Guide* and the Project Underground *Natural Resource Activity Guide* is available in Virginia to all classroom teachers as well as nonformal educators through 6-hour workshops taught by volunteer instructors. The educators who completed this training were certified as instructors. Workshops are free and can be scheduled any time for groups of 20 or more educators or youth group leaders. Shorter one-hour presentations on specific topics can also be requested. Several WET lessons were presented at the annual Environmental Education Conference on August 13-14 at Turner Ashby High School in Bridgewater, VA.

Interested people can become volunteer instructors by attending a **Leadership Workshop**. Volunteers become part of a statewide network to deliver water education and receive training and new materials on a regular basis. Applications are accepted for the free two-day seminar usually offered in the summer.

*For more on Project WET, see page 4*

## Farm\*A\*Syst

The Virginia Farm\*A\*Syst Program gained momentum across the Commonwealth in 1996, putting five pilot projects in place. These projects are located in the Cat Point Creek, Holmans Creek, New River Valley, Chestnut Creek, and Blackwater River watersheds. Approximately 40 on-farm water quality assessments have been conducted in the participating watershed projects.

A statewide advisory committee, made up of representatives from Virginia Department of Conservation and Recreation (DCR), Division of Soil and Water Conservation (SWCD), USDA-Natural Resources Conservation Service (NRCS), Virginia Department of Agriculture and Consumer Services and Virginia Farm Bureau Federation, continues to provide guidance to the program. In early 1997, three in-service training sessions were conducted

primarily for personnel from the Virginia Cooperative Extension, DCR, NRCS, and SWCD. Currently, support materials are under development that will help promote and implement the program. A brochure, video, and an educational display should all be available later this year.

Virginia Farm\*A\*Syst is a part of a nationwide effort to meet the challenges of potential threats to the rural ground water supply from agricultural uses. It is a voluntary, preventative program developed to provide safe drinking water and protect the health of Virginia's rural residents while reducing potential liability for the landowner due to ground water contamination. The program is designed to create an awareness of potential farmstead drinking water contaminants such as chemical and fuel storage tanks, livestock and poultry holding areas, irrigation systems and septic systems located near the farmstead well or spring.

Through this program, individual landowners can develop a personal, voluntary action plan. The landowner makes a step-by-step evaluation of the site using the program's Fact Sheets and Worksheets, which address factors such as soils and geologic properties, well-head or spring condition, and farmstead management practices that may impact the quality of the ground water/drinking water supply. The program participant identifies potential pollution sources and the risks associated with different practices. Once potential contaminants have been identified, the program continues to educate the landowner about appropriate ground water protection and clean-up activities. Corrective measures and/or management practices can be selected based on these identified risks to reduce the likelihood of future contamination and improve existing water quality. For more information contact Blake Ross of Virginia Cooperative Extension, 540-231-4702.

## ***Albemarle County Pilot Project: A Prototype Digital Hydrogeologic Data- base for Virginia***

In most parts of Virginia, ground water is the cheapest and most accessible water source. However, in the Blue Ridge and Piedmont portion of the state, uncertainty as to how much ground water is available in a given area is hindering local governments attempting to make informed decisions on critical issues of economic development and wise land use. In order to evaluate how much ground water is available in a particular place, and how good the water will be, one needs to have accurate information having to do with both ground water and geology. Since Spring of 1996, geologists at the Virginia Division of Mineral Resources (VDMR), Department of Mines, Minerals and Energy, have been developing a digital hydrogeologic database management system as a tool for studying problems related to ground water. Although Albemarle County has been the pilot study area, the project will be expanding in the near future to include other parts of the Thomas Jefferson Planning District.

The hydrogeologic database incorporates hydrologic data from water well completion reports, digital geologic and topographic map data, and water chemistry data from private and public wells. The goal has been to build an efficient framework with which to manage ground water and geology data in the digital realm on a desktop PC, using affordable commercially available software. "MapInfo" software was selected as a platform to interface geology and ground water spatial data layers; ground water inventory data reside in a relational database in Microsoft Access. VDMR is in the process of installing a server that will make the hydrogeologic database accessible over the Internet.

At present the database contains digital records for 1,773 water well completion reports and 498 chemical analyses from domestic wells. The records span a time period of more than

50 years. Source agencies for water well records and for water quality data have included the Virginia Department of Health, Virginia Department of Environmental Quality, Albemarle County Planning Department, and Virginia Division of Mineral Resources. Digital geologic data have been compiled at scales of 1:500,000, 1:100,000 and 1:24,000 using published and unpublished maps on file at VDMR. The computer software enables the user to query the database in order to evaluate the relationships between geologic features, water well productivity, and water quality.

The historical water well records are invaluable for purposes of studying long-term trends in water quantity and quality. However, the task of assembling these data in the digital realm while applying continuous database quality control has proven difficult and time-consuming. The level of completeness, legibility, and accuracy of the original records entered by the drillers is highly variable. The locations of the wells, critical information for entering the data into a spatial database, are in many cases recorded with insufficient accuracy to be readily entered into the system. Paper records are dispersed among several different agencies, each with a unique cataloging system. In some cases multiple records exist for the same well under different numbers at different agencies. Notwithstanding these challenges, the data input to date already shows a strong correlation between specific geologic formations and water well yields and chemistry. Thousands of paper records await entry into the database, however, as only about 20% have been entered to date.

Equally important to cataloging historical records in digital form is the need to develop better ways of collecting and managing water well data in the future. Fundamentally, higher quality data need to be recorded at the wellhead, and the new data need to be entered directly into the database by the responsible agency via the Internet. For Albemarle and the other four counties comprising the Thomas Jefferson Planning District, the agency responsible for collecting water well records is the Thomas Jefferson Health District (TJHD), within the Virginia Department of Health. VDMR has begun working with the TJHD to develop new proce-

dures for collecting water well data as part of their permitting and inspection protocol. TJHD personnel see great potential in the database management system for handling other types of spatial data such as drainfield data and soil types. In order to move this process along without necessitating up-front purchases of hardware and software by TJHD, VDMR will provide their workers with temporary use of a Global Positioning System (GPS) receiver, and requisite software to access the hydrogeologic database and input data.

Over the past six months VDMR has conducted demonstrations of our hydrogeologic database management system before many diverse audiences. Feedback following these presentations generally includes questions such as "Why has the State waited until now to get around to doing this?" and "When are you going to put together the data for (my) County?" It is not difficult to sell the notion that planners need an efficient way to work with hydrogeologic data in order to make informed decisions on a wide spectrum of issues. VDMR will attempt to meet requests that we expand our database beyond Albemarle County to the extent that individual localities are able and willing to share the costs of gathering and inputting data.

For more information, contact:

Nick H. Evans, Geologist Senior  
Virginia Division of Mineral  
Resources  
PO Box 3667, Charlottesville VA  
22903  
(804) 963-2317

## ***Electronic Permitting for Mining***

Strategy 2.01.02 in the Virginia Department of Mines, Minerals and Energy (DMME) 1997-1998 Strategic Plan states "The Divisions of Mined Land Reclamation and Mineral Resources, in collaboration with other Divisions, will lead the Department's efforts to establish electronic permitting and digital mapping." DMME through its Division of Mined Land Reclamation (DMLR) is initially committed to developing an Electronic Permit Application for coal surface mining operations. Development of the DMLR electronic permit will then aid in the future development of electronic permits for other DMME Divisions.

An electronic permit with up-linking and down-linking capabilities with the existing DMME/DMLR computer system will enable customers to submit permits electronically and DMLR to review the permits electronically. This information can then be uploaded to the Department's computer system without manual data entry. This will increase efficiency and eliminate potential data entry errors. The system may also include the capability for customers to link and download data for preparing permit applications. The goal is to be operational in 1998. This is part

of a larger effort DMME is making to provide customer access to all of DMME's electronic data and digital maps.

Many individual components of the proposed system are already operational. A DMLR/industry workgroup is finalizing a Standard Application Form, which establishes a standard format for easier uploading of information to the Department system. The entire Virginia coal field is covered by modern 7 1/2 minute geologic quadrangle maps. Digital 7 1/2 minute topographic quadrangle maps, covering the entire coal field and adjacent area, are now available for use as electronic base maps. To supplement these maps, DMLR is already building layers of digital map information, such as coal mine permit surface boundaries, extent of existing underground coal mine works layered by individual coal seam, the proposed underground mining limits by coal seam, and water monitoring point locations. About 85% of water monitoring reports (NPDES, surface water, ground water and rainfall) are currently received electronically and directly uploaded to the DMME/DMLR system. Manual data entry helps to complete the water monitoring record. All this information creates a valuable database for use in permitting and for other uses such as compliance monitoring, complaint investigations, and Abandoned Mine Land evaluations.

Information uploaded through the Electronic Permit Application system will rapidly add to this growing database.

Most necessary hardware and software are currently in place, requiring only periodic updating to utilize current technology to maintain efficiency of the system. The technical review/permitting staff now have hardware and software capable of viewing and writing comments on a complete electronic application, including narratives, digital maps, AutoCAD design plans, etc. The compliance field staff have laptop PCs with comparable capabilities and currently login via modem to access, upload and download information from the DMME/DMLR system. The laptops will enable the field staff to not only review electronic applications but to also utilize CDs containing the final approved permit package.

This has been a high profile topic for DMLR customers. Industry and consultants have expressed a desire and strong support for electronic permit applications. This has the potential to substantially reduce permitting costs for our customers. Additionally, the system will make information more readily available for DMLR compliance inspection and monitoring as well as to the public, to other agencies, and to other interested parties.

For more information, contact Lynn Haynes at 540-523-8179.

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## ***Advice to Home Buyers***

If you own a home or are in the market for one, make environmental issues a priority, advises the Virginia Ground Water Protection Steering Committee. Here are some suggestions for protecting your investment:

Be alert to underground home heating oil tanks. Older tanks can leak, contaminating surrounding soils and ground water. Leaking tanks cost homeowners money not only in lost oil but also in the cost of cleaning up contaminated soil and ground water.

If the oil tank is no longer used, consider having it removed. If you are purchasing a home, consider including tank removal or permanent tank closure as part of the purchase agreement.

Routine maintenance of your septic system helps protect ground water. The Virginia Department of Health recommends pumping out septic tanks every three to five years. When purchasing a previously owned home, obtain documentation on the last pumping of the tank and the location and size of the entire system.

About 1.4 million Virginians get their water from private wells. Periodic

analysis of your well water is recommended. When purchasing a home with a well, request documentation on proper well construction and maintenance. Be careful when applying pesticides, herbicides and fertilizers. Consider sharing chemicals with neighbors to reduce the need to store or dispose of unused chemicals. Never dispose of these products by pouring on the ground or into a stream, storm sewer, or septic system.

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## Rural Household Water Quality Education Program

To date, more than 6,000 households in 35 counties (see map and table) have participated in the program by collecting samples from their private, individual household water supplies and having them tested for general water chemistry and bacteriological contamination. This particular water quality testing and information program for rural households has been conducted in Virginia since 1989. The program's objectives are two-fold. First, through increasing awareness and understanding of water quality problems, protection strategies and treatment alternatives, the quality of life of rural homeowners and the health of the general environment can be improved, and secondly, a ground water quality data inventory to assist local governments in land use and ground water management decisions is being created.

The program is run on the local-level through Virginia Cooperative Extension Offices. Funding is provided by local governments, agencies, citizen organizations, and the participants, who are assessed a minimal testing fee.

When a county participates, two county-wide public meetings are held. The first meeting is held before the testing to explain local hydrogeologic characteristics in relation to ground water pollution, likely sources of and activities contributing to ground water contamination, the nature of household water quality problems (both nuisance and health related), and procedures for participation in the water testing program. The second meeting is held after the testing to disseminate and discuss test results with participants and

to suggest management practices that might be implemented to reduce or to prevent water contamination.

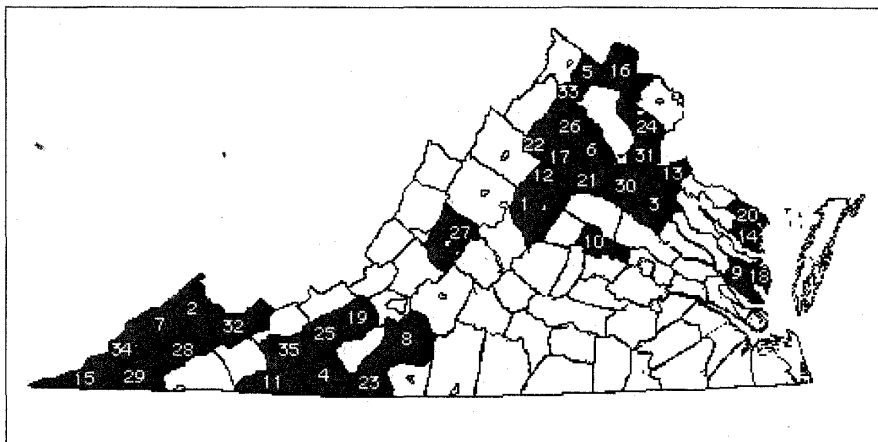
County residents can obtain two types of water sample testing kits, 1) a general water chemistry analysis for iron, magnesium, hardness, sulfate, chloride, fluoride, total dissolved solids, pH, saturation index, copper, sodium and nitrate; and 2) microbiological testing for fecal coliform and *E. coli* bacteria. In addition to the test results, other information is collected about each

also some *E. coli*. Analysis for pesticides and other chemical compounds revealed little evidence of such contamination, even though "high-risk" supplies were targeted.

Throughout the course of the programs, local government and public officials were informed of the general water quality results. All water quality test results, along with pertinent water supply characteristics were entered into a computer database, without identifying the individuals or property, to be used

for further analysis, for mapping, and for future county and regional planning. Summary reports are available for all counties shaded on the map, with the exception of Carroll, Grayson, and Patrick Counties for which final data are currently being summarized.

For additional information, contact Blake Ross of Virginia Cooperative Extension at 540-231-4702.



The Rural Household Water Quality Program has been conducted and completed in the following counties:

- |                 |                    |
|-----------------|--------------------|
| 1) Albemarle    | 19) Montgomery     |
| 2) Buchanan     | 20) Northumberland |
| 3) Caroline     | 21) Orange         |
| 4) Carroll      | 22) Page           |
| 5) Clarke       | 23) Patrick        |
| 6) Culpeper     | 24) Prince William |
| 7) Dickenson    | 25) Pulaski        |
| 8) Franklin     | 26) Rappahannock   |
| 9) Gloucester   | 27) Rockbridge     |
| 10) Goochland   | 28) Russell        |
| 11) Grayson     | 29) Scott          |
| 12) Greene      | 30) Spotsylvania   |
| 13) King George | 31) Stafford       |
| 14) Lancaster   | 32) Tazewell       |
| 15) Lee         | 33) Warren         |
| 16) Loudoun     | 34) Wise           |
| 17) Madison     | 35) Wythe          |
| 18) Mathews     |                    |

sample, such as the type of water source, water source environs, proximity to contaminant sources, and treatment devices installed. On the basis of this information and the results of the general water testing program, additional samples from a limited number of "high-risk" households are selected for testing of various chemical compounds.

Following the second public meeting, participants receive an evaluation survey in the mail. Respondents to these surveys have indicated that the primary reason for their participation in the program was concern about the safety of their water supply. They also indicated that the program increased their understanding of water quality. More than two-thirds of the households that reported having at least one water quality problem had taken or planned to take at least one measure to improve the quality of their water supply. Actions included shock chlorinating the system, conducting a follow-up water analysis, or seeking state agency assistance in correcting the problems.

The most widespread problem identified across Virginia is bacteriological contamination, mostly coliform but



# Understanding Ground Water Flow Systems

An adequate understanding of ground water flow systems is critical to achieving effective ground water protection. Ground water problems involve individuals from a broad array of backgrounds which may not include training and experience in the analysis of ground water flow. Consequently, efforts can be undertaken without adequate consideration of flow processes that largely control the conditions of concern. Investigators of ground water problems, as well as program managers charged with implementing and evaluating ground water-protection efforts, require an approach to mentally organize flow-system information and evaluate knowledge gaps.

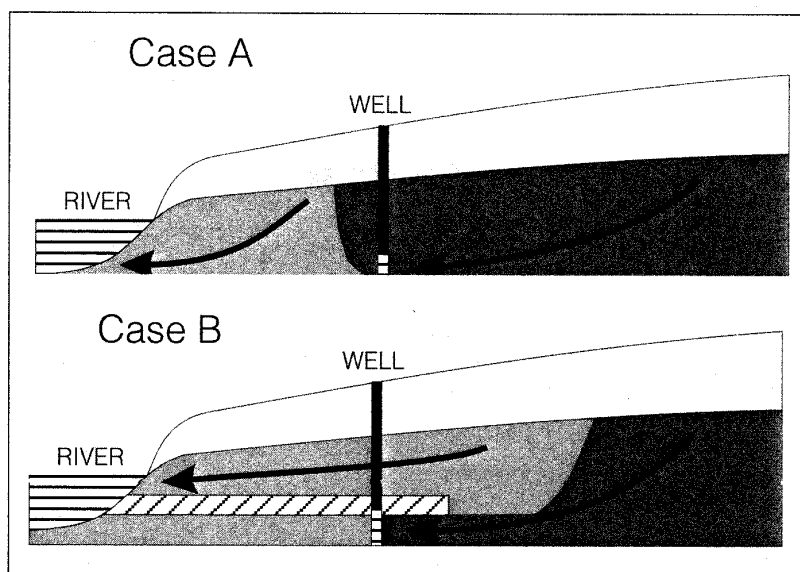
A perspective can be adopted that facilitates improved understanding of ground water flow systems. Information can be obtained and organized in two stages (see table). First, a framework is constructed to provide a qualitative spatial description of the system. Areas where water enters the system (sources) and leaves the system (sinks), and the routing of water (pathways) from the source(s) to the sink(s), are identified. The framework is based on flow-system lateral boundaries (such as surface water bodies and water table divides), vertical boundaries (such as the position of the water table), and internal geometry (such as the positions and properties of water bearing zones). Field investigation of hydrogeologic conditions provides the information for the framework.

Framework	Analysis
Source	Volumetric flow rate
Sink	Average linear velocity
Pathway	Traveltime

On the basis of the framework, an analysis can be undertaken to provide a quantitative description of the ground water flow system. The analysis includes time-related information (see table), including how much water is flowing (volumetric flow rates), how fast the water moves (average linear velocities), and how long the water takes to flow from one location to another (traveltimes). In some instances, the framework alone may be adequate to address a particular ground water

In addition, the model should be strengthened where possible with the use of independently obtained corroborative information, such as ground water age-date determinations.

A simple hypothetical ground water-flow model analysis (see figure) illustrates the importance of an adequate framework. The flow system shown includes an unconfined aquifer, with a well next to a river. In Case A, the well intercepts ground water from an area next to the well that extends upgradient.



Ground water downgradient of the well discharges to the river. Case A could probably be easily predicted from a cursory examination of field conditions. In Case B, a small but significant change has been made by the addition of a thin clay layer above the open interval of the well. As a result, the well intercepts ground water from an area upgradient and away from the well. Ground water from the area next to the well is not intercepted but continues downgradient and discharges to the

river. In other cases, the information provided by analysis may be of central importance, such as determining the sustainable yield from an aquifer, or the length of time for a contaminant to migrate over a given distance. The framework must still be established, however, before the analysis can be undertaken.

Analysis involves some form of mathematical calculation, using information obtained from field investigation and also often from additional sources, to estimate flow rates, velocities, and traveltimes. The complexity of the analytical approach can vary widely. Modeling is popular because detailed features of the flow system can be analyzed. A correspondingly large and often iterative effort is required, however, to obtain meaningful results: model weaknesses must be evaluated based on areas of uncertainty in the framework, and model results may indicate needed refinements to the framework (possibly requiring additional field investigation).

Case B likely would not be predicted without knowledge of the clay layer, and an evaluation of potential contaminant sources to the well could be in error.

Ground water problems are inherently diverse and complex, and even the most thorough flow-system analysis will retain some degree of uncertainty. In addition, chemical processes that can further control the conditions of concern must also be addressed in many instances. The scope of every effort is limited by financial constraints, and evaluating the adequacy of the knowledge obtained is subjective. Experience and open-mindedness, however, can contribute significantly to efforts that are necessarily limited in scope. Regardless of the individual's expertise, a perspective that recognizes the importance and limitations of understanding the flow system can greatly enhance efforts to protect ground water.

## Amendments to Ground Water With- drawal Regulation

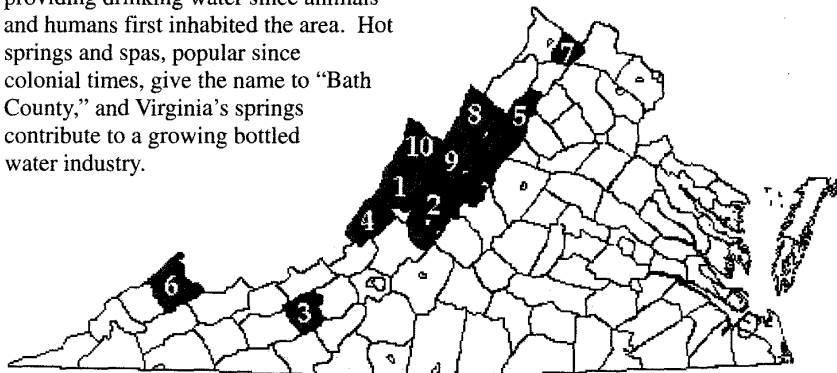
In 1993 the Department of Environmental Quality (DEQ) adopted ground water withdrawal regulations that did not include specific requirements for agricultural users to obtain ground water withdrawal permits. This decision was based on the fact that the agricultural community had previously been exempt from ground water withdrawal requirements and the Agency's desire to obtain input from them concerning this aspect of the regulation. DEQ convened an Agricultural Ground Water Advisory Committee that was composed of representatives from state and federal , agency's with knowledge of the agricultural community, agricultural producers associations, and individual agricultural producers. This committee provided recommendations to DEQ in late summer of 1993. During the fall of 1993, DEQ held two public meetings (Williamsburg and Accomac) to obtain additional public comment regarding agricultural ground water withdrawal requirements.

Since the fall of 1993 several changes have occurred that also require amendments to the Ground Water Withdrawal Regulation. These actions include the review of this regulation subject to Executive Order 15-94, legislative amendments to the Act passed by the 1994 session of the General Assembly, and the desire to establish regulatory requirements for the periodic review of regulations.

Executive Order 15-94 required the evaluation of all state regulations. The most significant recommendation that resulted from this review of the ground water withdrawal regulation was that DEQ take the responsibility of performing technical evaluations of the impacts of proposed withdrawals. The existing regulation places this requirement on ground water withdrawal permit applicants. This proposed change will relieve the burden of the regulation on the regulated community and improve the technical rigor of the evaluations. It is important to note that in all similar permitting programs, DEQ already is tasked with performing all required technical evaluations.

## Large Springs of Virginia

Springs are an important part of Virginia history! One way of thinking about these natural wonders is that they are "ground water that you can see." Virginia's springs have been providing drinking water since animals and humans first inhabited the area. Hot springs and spas, popular since colonial times, give the name to "Bath County," and Virginia's springs contribute to a growing bottled water industry.



County	Spring	Discharge (GPM)	County	Spring	Discharge (GPM)
1. Bath	Coursey	11,612	6. Buchanan	Carter Hall	6,000
2. Rockbridge	Spring Creek	11,025	7. Clarke	Green Mount	5,500
3. Pulaski	Woolwine	10,300	8. Rockingham	Baker	5,300
4. Alleghany	Falling	7,000	9. Augusta	Lacey	5,300
5. Page	Yeager	7,000	10. Highland	Mackey	5,200

The 1994 session of the General Assembly passed an amendment to the Ground Water Management Act of 1992 that extends the window of opportunity for community waterworks to claim withdrawal permits based solely on the historic withdrawals. The original Act required DEQ to issue permits to persons who held ground water withdrawal permits issued subject to the Ground Water Act of 1973 for an amount of water equal to the amount of withdrawal that occurred in twelve consecutive months between July 1987 and July 1992. This amendment expanded the window of opportunity for community waterworks to twelve years. This amendment requires DEQ to issue ground water withdrawal permits to persons who held ground water withdrawal permits that support community waterworks for an amount of water equal to the amount of withdrawal that occurred in twelve consecutive months between July 1980 and July 1992.

In the fall of 1996 DEQ renewed activity regarding these regulatory amendments. The four purposes of the proposed amendments are (1) to enact

regulations for agricultural withdrawals, (2) to incorporate language from the 1994 legislative amendment, (3) to require DEQ to perform technical evaluations, and (4) to establish a periodic review of the regulation.

In April of 1997 the State Water Control Board authorized staff to proceed with steps necessary to hold public hearings. It is anticipated that hearings will be held in the late summer of 1997 and public comments will be accepted at that time.

For additional information contact Terry Wagner at 804-698-4043.

### III. INFORMATION SOURCES

#### ***Frequently Asked Questions (FAQ's)***

*Do you know where your well water comes from?*

Rain infiltrates the land surface and percolates downward to the water table during a process called "recharge." Ground water then moves laterally to eventually be intercepted by a pumping well or discharge to surface water. The "recharge area" for a well depends on how deep the well is and in what types of rock or sediment it is located. Throughout Virginia, shallow dug or bored wells are not much deeper than the water table and usually obtain water that infiltrated relatively nearby, typically within about a mile. Recharge areas for deeper wells are more variable. Recharge to wells drilled into rocks in the Piedmont and Blue Ridge also is fairly localized. Wells drilled into rocks in the Valley and Ridge sometimes intercept water that has traveled as far as several miles, particularly in limestone areas with large cave systems. In the Coastal Plains, wells drilled into deep sand layers can intercept water that

traveled several tens of miles, from recharge areas that may be several counties away.

*Do you know what is in your well water and how it got there?*

Several chemical constituents called "major ions" originate from the mineral gains in the rock or sediment with which ground water is in contact, and usually make up the bulk of the dissolved material. In Virginia, "hard" water can have high concentrations of certain major ions, especially in limestone areas of the Valley and Ridge, that can cause scaling of plumbing fixtures and other problems. Other "minor" elements also originate from the materials, but are at lower concentrations because they do not dissolve easily or are less abundant in the minerals. Nevertheless, some problems commonly result from certain minor elements. Large amounts of iron in the rock in some areas, particularly the Piedmont and Blue Ridge, result in iron "staining." Sulfide in ground water in parts of the Valley and Ridge where coal or natural gas is present produces an obnoxious odor. In addition to natural constituents, ground water also can be contaminated by human activi-

ties. Bacteria from septic systems, and nitrate from both septic systems and fertilizer applications, are among the most common contaminants. A wide variety of other chemicals can also contaminate ground water, although usually affecting a relatively small area, including organic compounds spilling from fuel and solvent storage facilities, and metals from waste-disposal operations. People suspecting possible contamination of a water-supply well should contact their local health department official or the appropriate DEQ Regional office.

*Do you know what the Agricultural Stewardship Act is, and how it applies to ground water? Or how development can be planned to protect ground water supplies? Or when a ground water withdrawal permit is required? Or whether ground water monitoring is required at all landfills?*

For answers to these and other frequently asked questions, visit the Ground Water Protection Committee's new web site at:

<http://www.deq.state.va.us/gwpsc/home.html>

#### ***Ground Water Protection Steering Committee Membership***

##### **Dept. of Environmental Quality (DEQ), Chair**

(Web site: <http://www.deq.state.va.us/>)

**Ground Water Protection** contact: Mary Ann Massie, 804-698-4042

**Waste Management Issues** contact: Howard Freeland, 804-698-4219.

##### **Chesapeake Bay Local Assistance Department (CBLAD)**

Contact: Margie Reynolds, 804-371-0608.

##### **Cooperative Extension (VCE)**

(Web site: <http://www.ext.vt.edu/>).

Contact: Waldon Kerns, 540-231-5995.

##### **Dept. of Agriculture and Consumer Services (VDACS)**

(Web site: <http://www.state.va.us/~vdacs/vdacs.htm>).

Contact: Sara Pugh, 804-786-3539.

##### **Dept. of Business Assistance (DBA)**

Contact: Dean Bailey, 804-371-8228.

##### **Dept. of Conservation & Recreation (DCR)**

Contact: Stu Wilson, 804-786-4382.

##### **Dept. of General Services, Div. of Consolidated Laboratory Services. (DCLS)**

Contact: Ed LeFebvre, 804-786-3767.

##### **Department of Health (VDH)**

(Web site: <http://www.vdh.state.va.us/>).

Contact: Eric Bartsch, 804-786-1760.

##### **Dept. of Housing & Community Development (DHCD)**

Contact: Barry Brown, 804-371-7061.

##### **Department of Mines, Minerals, and Energy (DMME)**

Contact: Lynn D. Haynes, 540-523-8179.

##### **U.S. Geological Survey (USGS), Water Resources Division**

(Virginia District's web site: <http://www-va.usgs.gov>; Bureau-wide web site: <http://www.usgs.gov>).

Contact: Randy McFarland 804-278-4750, ext. 267.

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## ***Publications Available***

The Ground Water Protection Steering Committee has prepared a series of documents aimed at increasing awareness of ground water, the need to protect and conserve this essential resource, and strategies and methods of accomplishing these goals. Besides *Annual Reports* dating back to 1988, publications include:

*A Groundwater Protection Strategy for Virginia*, May 1987  
*Virginia's Groundwater Protection Strategy: A Summary Report*, May 1987  
*1990 Supplement to a Groundwater Protection Strategy for Virginia*, 1990  
*Wellhead Protection: A Handbook for Local Governments in Virginia*, 1992  
*1995 Supplement to a Groundwater Protection Strategy for Virginia*, 1995

Free copies of these reports and additional copies of the **1997 Annual Report** can be obtained from Mary Ann Massie, Department of Environmental Quality, P. O. Box 10009, Richmond, Virginia 23240-0009, or call 804/698-4042.

The United States Geological Survey has many publications about ground water and ground water related issues. For information about Virginia publications, you may contact the Virginia District Office, Richmond, at 804-278-4750. For publications of general interest, ask for a USGS catalog of titles in the series "General Interest Publications of the U.S. Geological Survey." Here is ordering information:

Water Information Center (general information): (800) 426-9000  
Phone orders, all products: (800) 435-7627

Mail orders:  
USGS Information Services  
Box 25286  
Denver, CO 80225

The Virginia Water Resources Research Center is a good source of publications of both general interest and for research purposes. You may contact them at:

Virginia Polytechnic Institute and State University  
10 Sandy Hall  
Blacksburg, VA 24061-0444  
Phone: (540) 231-5624  
Fax: (540) 231-6673

## ***Ground Water Protection Steering Committee Develops its Own World Wide Web Site!***

Do you want to learn more about the Steering Committee's work? Would you like to attend a meeting of the Steering Committee? Or maybe you just want a good source of web sites with ground water information. If so, have we got a site for you!

By the time you read this *1997 Annual Report*, the Steering Committee web site will be up and running.

On that site you will find information about publications, frequently asked questions about ground water in Virginia, and links to other good sites. Feel free to let us know what you think of the site while you're there!

<http://www.deq.state.va.us/gwpsc/home.html>

### ***• Virginia On-Line***

This "world wide web" home page is accessible via the Internet and provides information from a growing range of state agencies and programs. Virginia On-Line's URL address is <http://www.state.va.us/>

### ***• Spread the Word***

Do you know of an individual or organization who would benefit from receiving a copy of this and future Annual Ground Water Reports? Call Mary Ann Massie at (804) 698-4042 to add names to the mailing list.

*Water quality preservation is everyone's concern.  
If you suspect a pollution incident has occurred, please call:*

**Department of Emergency Services**

**1-804-674-2400 24-hour hotline**